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Assessment of factors associated with positive results using visual inspection with acetic acid or Lugol's iodine among women screened for cervical cancer at Muhima District Hospital, Rwanda

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ABSTRACT

Introduction: Cervical cancer is a critical concern to women's health and lives globally. Visual inspection of the cervix allows identification and early treatment of the presence of a precancerous lesion. In Rwanda, little is known about factors associated with positive visual inspection with acetic acid (VIA) or visual inspection with Lugol's iodine (VILI) results. The overall objective of this study was to assess the factors associated with positive results of VIA and VILI testing among the women attending Muhima District Hospital for cervical cancer screening.

Methods: This investigation was a descriptive retrospective study conducted at Muhima District Hospital. The study population included 2,160 files of women screened for cervical cancer using VIA/VILI. The Yamane Taro formula was used to identify the necessary study sample equivalent to 339 files. Only 332 of the randomly selected files met all eligibility criteria and were used for analysis. Data were collected using a checklist developed for the purposes of this study and SPSS (version 22) was used for data analysis. Frequency distributions were calculated, and chi-square tests were used to determine the factors associated with positive VIA/ VILI.

Result: The rate of VIA/VILI positive result was 18.07%. The age [AOR (95% CI) = 2.8.9, *p*-value of 0.00] and number of sex partners [AOR (95% CI) = 8.78, *p*-value of 0.03] of the participants were significantly associated with positive VIA/VILI results.

Conclusion and recommendation: Positive VIA/VILI results were associated with age and number of sexual partners in this sample of 332 women. The presence of precancerous lesions can be identified through visual inspection using acetic acid or Lugol's iodine. Screening with this approach could be useful in reducing the burden of cervical cancer, especially in low resource settings.

Keywords: Cervical cancer; positive VIA; positive VIA/VILI; factors associated with positive VIA for cervical cancer

BACKGROUND

Cervical cancer is a critical concern to women's health and lives globally (Arbyn et al., 2020n). It is estimated that one woman dies of cervical cancer every 2 minutes (World Health Organization [WHO], 2021). Visual inspection of the uterine cervix with acetic acid (VIA) and Lugol's iodine (VILI) are cervical cancer screening options recommended by the World Health Organization (WHO; WHO, 2002). Positive VIA and VILI results confirm the presence of a precancerous lesion (Nkwabong et al., 2021) and facilitates early intervention. Knowing the factors associated with the positivity of VIA and VILI is among the best measures to fight against the increasing numbers of cervical cancer diagnoses (Meharry et al. 2019) and could be helpful in focusing public education programs. Thus, the current study was designed to determine the prevalence of positive VIA/VILI results among the women screened for cervical cancer at Muhima Hospital, and the factors associated with positive VIA/VILI results.

The literature contains reports from various settings regarding factors associated with positive VIA and VILI results. The factors include early initialization of sexual intercourse below the age of 16 years, multiple sexual partners, multiparity, smoking habits, use of hormonal contraception, and human immunodeficiency virus (HIV) infection (Denny et al., 2017; Orang'o et al., 2017). However, there is a need to enhance the knowledge of factors associated with positive results using VIA and VILI, especially in the local context of a low-resource country. Knowing the factors could help with education programs, not only for the women at greater risk, but also for nurses and midwives who care and educate women (Djordjevic, 2019; Arbyn et al., 2018).

Since 2012, in Rwanda, cervical cancer screening activities using VIA/VILI have been occurring at different health facilities (Ruzigana et al., 2017), but very little is known about the factors associated with positive VIA and VILI results in this

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setting. Hence, the primary purpose of this study was to identify the factors associated with positive results of VIA and VILI among Rwandan women screened for cervical cancer.

METHODS

Approach and design

This study used a non-experimental quantitative approach and was designed as a descriptive retrospective study.

Research setting

Muhima Hospital is a district hospital located in Nyarugenge District in Kigali City, the capital of Rwanda. It is one of the district hospitals that has been performing regular cervical cancer screening since 2012. At Muhima Hospital, the Women Cancer Early Detection (WCED) service screens about 25 females on average per month.

Ethical permission to conduct the study was obtained from the UR-CMHS Research Center's Institutional Review Board and from the Muhima District Hospital Director General. The manager of WCED arranged for collecting the required files for the years 2012–2020 and obtaining the space to review them.

Population and sample

The WCED service at Muhima Hospital screened a total of 2,160 women for cervical cancer using VIA/VILI during the period from 2012 to 2020. The files of this total group were considered the target population of this study. All files were considered eligible with the exception of those used for the pilot evaluation and those for women who were beyond the age of 49 years. This age group beyond 49 are not considered appropriate for screening using VIA/VILI (Binagwaho et al., 2013).

Sample size and sampling strategy

The sample size was calculated using the Yamane Taro formula (26; Yamane, 1967). In this formula n = corrected sample size, N = population size, and e = Margin of error (Moe), $e = 0.05$ based on the research condition (Macpherson et al., 2017). Thus, with the total population of $N = 2,160$, the sample size for this study was determined to be 339 files.

The sample files were selected using a systematic random selection strategy. A sampling frame was constructed by giving the 2,160 files a unique study number. The researcher selected every sixth file until 339 cases were selected. The 339 files were reviewed to determine the age of the women and the degree of missing data. Seven women were found to be older than 49 years and, thus, were not eligible for the screening test and were not included in the analysis. This review left 332 eligible files, which were used for data extraction and analysis.

Validity and reliability of the instrument

The data collection checklist tool for this study was based on an original tool created and used by Deksissa et al. (2015), to explore the prevalence and factors associated with VIA positive results among clients screened at the Family Guidance Association of Ethiopia, in Jimma, Ethiopia. This tool included 14 questions in total. Parts 1, 2 and 4 related to the prevalence of positive VIA/VILI results and Parts 2 and 3 contained questions related to various factors that could be associated with positive VIA/VILI results.

After obtaining the Deksissa et al.'s, permission to use the tool for this current study, the tool was adapted for the Rwandan Context by the researcher (a clinical oncology nurse with expertise in the topic area) through reviewing the content and face validity of the original tool. To determine the face and content validity of the adapted instrument for the Rwandan context, the instrument checklist was given to three individuals with expertise in cancer cervical screening. They were asked to assess the face and content validity of the checklist items prior to data collection.

In this study, the researcher gathered all the data from the women's charts. To check intra-rater reliability, the researcher reviewed 10 charts during the pilot step two times, with interval of one month, and compared whether the same information was extracted from the charts on each occasion. There was 100% agreement.

Data collection

Pilot study: Prior to full data extraction, the checklist tool was assessed for applicability in the study. Thirty (30) files were selected randomly, half from the positive result files and half from the negative result files, and used to assess the checklist. This number was determined by taking 9% of the sample as indicated from the formula of Cocks and Torgerson (2013). This pretesting provided insight into whether the proposed instrument or method was appropriate or not.

Adaptation of the tool was made in accordance with the results from the pilot step. A number of items were not available in the patient file documents and, thus, had to be eliminated from the checklist: identifications (MRN not recorded, no VIA register recorded, no names of the participants, and no telephone numbers); reproductive history (no pregnancy status recorded, no menstrual periods recorded, and no data regarding menopause recorded); and no cervical maps or data regarding actual examination process were recorded. Additionally, history of corticosteroid use, previous pap smears, and history of STIs for participants' partners were not recorded.

The checklist used for data extraction contained demographic data, such as age, marital status, and educational level, and factors potentially associated with VIA results, including age at first sexual activity, number of sexual partners, number of parity, sexually transmitted diseases, family planning method, History of STIs, HIV status, and VIA results.

Data analysis

SPSS (22 version) software was used for analysis. Descriptive analysis of all variables was completed including proportions, frequencies and means. Inferential analysis was completed using Chi-square tests for identifying factors associated with the positive VIA result.

RESULTS

Selected Demographic Results

Of the 332 files for which data were extracted, the women ranged in age from 15 to 49 years, with the majority older than 30 (88%; See Table 1). About two-thirds of the women were married (62%) and had a primary school education (66%).

Table 1

Demographic Characteristics of Respondent

Demographic Variable Name	Categories of Variable	Frequency in Total Sample (N = 332)	Frequency of Those in Positive VIA/VILI Group (n = 60)	Frequency of Those in Negative VIA/VILI Group (n = 272)	Chi-Square Statistic X ²	P Value
Age group of the women participants	Age between 15–29 years old	37	6	31	[AOR (95%CI) = 28.9]	0.000
	Age between 30–49 years old	295	54	241		
Marital status of the women participants	Single	58	13	45	[AOR (95%CI) = 3.73]	0.44
	Married	207	40	167		
	Separated	16	2	14		
	Divorced	9	1	8		
	Widow	41	4	37		
First age of having sex	Below 12 years	5	1	4	[AOR (95%CI) = 3.7]	0.15
	Age between 12–16 years	9	0	9		
	Age between 17–24 years old	219	47	172		
	Above 24 years old	99	11	88		
The number of parity of the participant	Null para	41	2	39	[AOR (95%CI) = 4.86]	0.301
	Parity below or equal to 2	71	12	59		
	Parity between 3–5	122	28	94		
	Parity between 6–7	74	12	62		
	Parity equal to or above 7	24	4	20		
Number of sexual partners of the participants	None or 0	125	18	107	[AOR (95%CI) = 8.78]	0.03
	One	95	15	80		
	Two	103	25	78		
	above two	3	1	2		
Educational level of the women participants	None	9	3	6	[AOR (95%CI) = 1.47]	0.68
	Primary	219	39	180		
	Secondary	76	13	63		
	University	28	5	23		
Family Planning method used by the participants	Microgyno	66	17	49	[AOR (95%CI) = 8.2648]	0.0823
	Injectable	102	16	86		
	Implano and jadelle	64	10	54		
	IUD and bilateral tubal ligation (BTL)	61	13	48		
	Not applicable	39	2	37		
History of STIs among participants	Positive	22	4	18	[AOR (95%CI) = 0.46]	0.94
	Negative	310	53	257		
HIV/AIDS testing of the participants	Positive (reactive)	58	13	45	[AOR (95%CI) = 0.51]	0.475

Note. VIA/VILI = visual inspection with acetic acid/visual inspection with Lugol's iodine; AOR = adjusted odds ratio; CI = confidence interval; IUD = intrauterine device; STIs = sexually transmitted infections; HIV = human immunodeficiency virus; AIDS = acquired immunodeficiency syndrome.

Sixty-eight percent of the respondents indicated their age for first sexual activity was between 17 and 24 years and 24.5% indicated they had had two or more sexual partners. Thirty-seven percent had had three to five pregnancies and 91% reported no history of sexually transmitted diseases. Seventeen percent were HIV-positive.

Overall, there were 60 positive cases (18.07%) and 272 negative cases (81.92%) on VIA/VILI results in the total sample.

The two groups of women were similar in terms of marital status, educational levels, number of pregnancies, were older than 17 at the time of first sexual activity, family planning methods used, having a history of sexually transmitted diseases (STDs), and having been tested for HIV (See Table 1). However, the groups differed in terms of age and number of reported sexual partners. In the group of 60 women who had positive VIA/VILI results, 62% ($n = 54$) were older than 30 years of age, while the group with 272 women with negative results had 89% ($n = 241$) over the age of 30 years. In the group with positive results, 30% ($n = 18$) reported no sexual partners and 43% ($n = 26$) reported two or more sexual partners. In the negative results group, 40% ($n = 107$) reported no sexual partners and 29% ($n = 80$) reported two or more sexual partners.

Test for Association of Variables with Positive VIA/VILI results

A Chi-Square test was performed to determine the association between the selected variables and the positive VIA/VILI results in this sample including age, age at first having sex, history of previous STI's, HIV status, number of sex partners, number of parity, and marital status (see Table 2).

Two variables were found to be associated with positive results. The age of the participants was found to have a significant association with the results [AOR (95%CI) = 28.9, p -value = 0.000]. The Chi-squared test regarding history of number of sexual partners [AOR (95%CI) = 8.78, p -value = 0.03] was also statistically significant. None of the remaining factors, including age at first sexual activity, history of previous STIs, history of HIV status, number of pregnancies, or marital status were found to be associated with positive results.

DISCUSSION

This study was undertaken to identify factors associated with positive VIA/VILI results in a Rwanda hospital setting. The findings provide insight into the rate of positive results and two factors associated, at a statistically significant level, with the positive results. The study findings also point to areas of documentation in the patient medical records that need improvement.

In this study, the rate of VIA/ VILI positive results was 18.07%. The magnitude of this finding is higher than that found in studies done in Nepal (7.9%; Acharya Pandey & Karmacharya, 2017), and Myanmar (11.32%; Thinn et al., 2023). The result in this Rwandan sample is also higher than the 12.9% reported in Ethiopia using the original checklist tool (Deksissa et al., 2015). This might be due to the situation that, in the beginning, when cervical cancer activity was initiated in 2012, many symptomatic cases were screened.

The rate of positive results reported in this study was an increase over the rates in VIA/VILI-positive cases reported earlier in this country. In 2013, in three districts of Rwanda, the rates were 5.9% (Makuza et al., 2015). The current finding was also higher than that of East-African community countries, such as Tanzania (9.7%), and Uganda (7.8%; World Health Organization, & International Agency for Research on Cancer, 2012). The higher rate of positive VIA/VILI results might be because Muhima Hospital is located in the city with more sexual workers and the associated sexual health risks. Also, from 2012, Muhima Hospital was the only hospital to perform the VIA/VILI screening tests. Other hospitals started later. During the period for which files were reviewed, everyone with signs and symptoms from various districts consulted the Muhima Hospital service. Also, during the period, there was an increase in awareness in the community regarding cancer in general, as different organizations, including the Rwanda Ministry of Health and the Rwanda Biomedical Center, trained their personnel to educate the community about cancer. The emphasis was placed especially on breast and cervical cancers and the need to go for screening.

The current study identified only two factors associated with positive VIA/VILI results, age of the participant and numbers of sexual partners. This differed from previous studies that identified factors associated with positive VIA and VILI results as early initialization of sexual intercourse below 16 years, having multiple sexual partners, multiparity, smoking habits, use of hormonal contraception, and HIV infection (Denny et al., 2017; Orango et al., 2017; Seth et al., 2019). In a Bangladesh study, researchers reported that age and multiparity played important roles as factors causing cervical cancer. Women with multiparity had more than twice the likelihood of developing cervical cancer (Abedin et al., 2019). These variations may be emerging for different reasons. The demographics of the samples included in the various studies may differ as well as the nature of data collection. Some studies utilized self-report, while this one utilized document records. For future research studies on this topic, it is important to ensure there are consistent population characteristics and data collection approaches in order to compare findings.

This current study also varied from the one previous study on screening for cervical cancer conducted in Rwanda by Makuza et al. (2015). In the previous study, the associated factors included initiation of sexual activity before 20 years of age and being unmarried (i.e., single, divorced, and widowed). Neither age at first intercourse nor marital status were found to be significant in this current study.

The interplay of age with other life events is likely an important consideration when examining factors associated with positive VIA/VILI results. Age likely is a relevant variable when understanding the probability of certain life events occurring for females. Initiation of sexual activity, number of sexual partners, multiparity, and use of contraception methods could well be linked with age. This could be a focus for future study.

The identification of the two factors associated with positive VIA/VILI results has implications for education. Reference to these factors ought to be incorporated into education programs for the general public, as well as for health care professionals. It is especially important for nurses who care for

Table 2*Association of Selected Variables With Positive VIA/VILI Results*

Variables	Categories	Group With Positive VIA/VILI	Group With Negative VIA/VILI
Age in years	Age 15–29	6	31
	Age 30+	54	241
Chi Square Statistic X² and P value	[AOR (95%CI) = 28.9]	P-Value = 0.000	
Age in years having 1st sex	Below 12	1	4
	12–16	0	9
	17–24	47	172
	>24	11	70
Chi Square Statistic X² and P value	[AOR (95%CI) = 3.7]	P-Value = 0.15	
History of previous STIs	Yes – had STIs	4	18
	No – did not have STIs	53	248
Chi Square Statistic X² and P value	[AOR (95%CI) = 0.46]	P-Value = 0.94	
HIV status	Positive HIV	13	45
	Negative HIV	40	179
Chi Square Statistic X² and P value	[AOR (95%CI) = 0.51]	P-Value = 0.475	
Number of sexual partners	None or 0	18	107
	One	15	80
	Two	25	78
	Above two	2	1
Chi Square Statistic X² and P value	[AOR (95%CI) = 8.78]	P-Value = 0.03	
Number of parity	Null-parity	2	28
	1–2	12	59
	3–5	28	94
	6–7	12	62
	Above 7	4	20
Chi Square Statistic X² and P value	[AOR (95%CI) = 4.86]	P-Value = 0.301	
Marital status	Single	13	43
	Married	40	167
	Separated	2	14
	Divorced	1	8
	Widowed	4	37
Chi Square Statistic X² and P value	[AOR (95%CI) = 3.73]	P-Value = 0.44	

Note. VIA/VILI = visual inspection with acetic acid/ visual inspection with Lugol's iodine; AOR = adjusted odds ratio; CI = confidence interval; STIs = sexually transmitted infections; HIV = human immunodeficiency virus.

women's health to be able to instruct their clients about cervical cancer screening and to assess the potential presence of significant factors associated with positive test results.

A final point arising from the observations from this study concerns the improvement needed in record keeping within a screening program. It would benefit both research and clinical practice if screening documentation contained all information related to the salient variables that could be factors associated with cervical cancer. Comprehensive recording would allow

greater understanding about the various factors and better planning for education programming.

Limitations and challenges

This study has a number of limitations. It was conducted at one hospital or health setting, which limits its generalizability, despite the observation that women came from across the country in the early part of the data collection period. Another limitation concerns the missing data in the patient medical files or charts, which can be an issue in retrospective study designs, but

which meant some factors could not be assessed as originally intended. Some of the variables identified for study extraction were not routinely recorded in the women's files and, thus, the information for these variables of interest was not available for extraction or analysis. There could be other factors associated with positive results that are not identified in this work.

CONCLUSIONS AND RECOMMENDATIONS

This study was conducted in Rwanda to determine which factors are associated with positive VIA/VILI results following cervical screening. The study revealed that the rate of

VIA/VILI positive results, in a randomly selected sample of women screened for cervical cancer at one health facility, was 18.07%. The factors of age and number of sex partners of the participants were significantly associated with positive VIA/VILI results. Thus, raising awareness for the whole community about cervical cancer screening with VIA/VILI to women aged between 30–49 years old, and the associated factors, should be encouraged. It is also important that more research concerning the factors associated with positive VIA/VILI results of cervical screening be conducted using data collection approaches, which would allow for more in-depth exploration than can be achieved through a record review alone.

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